*Reporting Federal Activities . . .*

# Higher Education

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*Research and the Financing of Higher Education*

HERBERT H. ROSENBERG

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Office of Education

# Contents


FEATURES — Page

Research and the Financing of Higher Education, Herbert H. Rosenberg . . . 3
Implications of Present Military Manpower Build-up for Colleges and University Faculty and Students . . . 19

OFFICE OF EDUCATION STUDIES AND SURVEYS

Trends in Faculty Salaries . . . 21
Faculty and Other Professional Staff of Institutions of Higher Education 1959–60 . . . 22

OTHER PROGRAM NOTES

Acting Director of Higher Education . . . 23
Regional Representatives . . . 23

NEW PUBLICATIONS . . . 23



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# Research and the Financing of Higher Education

BY HERBERT H. ROSENBERG*

LAST YEAR the Nation spent about $1.2 billion for research in institutions of higher education (table 1). This represents $1 out of every $5 spent for higher education in 1960 as compared with $1 out of $10 in 1950 and $1 out of $25 in 1940. Between 1930 and 1960, expenditures for research increased 5.5 times as rapidly as total expenditures by colleges and universities. This trend clearly indicates the mounting significance of research in the financing of higher education.

Higher education in the United States has been defined as "that convenient abstraction which permits one to deal coherently with not far from 2,000 institutions of learning, diverse in character and involving millions of people engaged in a bewildering variety of activities." [1] This abstraction is not, however, very convenient for appraising the impact of research upon the financing of higher education because 186 universities and technological schools—less than 10 percent of the 2,000 institutions—consistently account for 97 percent of the research funds.

Research activities do not now affect in any major or direct sense the financing of other equally vital institutions—liberal arts colleges, teachers colleges, theological and other professional schools, junior colleges, and technical schools. But research does play a powerful role, sometimes the dominant one, in financing the activities of the 186 universities and technological schools. These institutions award more than one-half of all the bachelor's degrees granted in this country and constitute the Nation's main resources for graduate and professional training. In these institutions research influences the intellectual climate of graduate and undergraduate education, the character of the physical facilities, the size, composition, and ambitions of the faculty, the nature of instruction, the aspirations of the students; it is crucial to the financing of all their other educational activities.

Someone has likened reading Proust to peeling the successive layers of an onion. In this article I intend to peel away the gross impressions derived from aggregate data and qualitative speculations in order to describe the impact of sponsored research upon the financing of higher education.

## GROWTH OF RESEARCH

As a component of university expenditures, research was of little consequence prior to World War II. In 1940, the institutions of higher education in the United States spent $28 million for organized research—5 percent of their total expenditures for educational and general purposes.[2]

For the three periods for which data from the Office of Education biennial surveys permit closer scrutiny by type of institution and control, 1953–54, 1955–56, 1957–58, it is evident that: (1) Universi-

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A detailed treatment of this subject by the same author will appear in "The Economics of Higher Education," Selma J. Mushkin, *ed.*, now in preparation in the Office of Education.

[1] National Manpower Council, *Education and Manpower*, Henry David, *ed.*, New York, Columbia University Press, 1960, p. 290.

[2] Expenditures for educational and general purposes do not include items such as student aid and auxiliary enterprises not directly relevant to financing educational activities *per se* and therefore provide a more appropriate base for comparison with expenditures for organized research than do total expenditures.

ties and technological schools consistently account for about 97 percent of organized research expenditures by institutions of higher education; (2) the distribution of research funds among public and private universities closely approximates their numerical relationship, 81 public, 60 private; (3) the 21 private technological schools receive substantially more research funds than the 24 public ones; and (4) the proportion of expenditures for educational and general purposes devoted to research is largest for the technological schools, especially those privately controlled, and it is substantially larger for universities than for the remaining types of institutions (table 2).

During this period of growth, research has expanded in two distinct patterns. One pattern is represented by the creation of large-scale, off-campus research centers wholly supported by the Federal Government and staffed almost exclusively with full-time researchers. About one-half of all the expenditures for organized research is concentrated in a few major research centers such as Los Alamos, the Jet Propulsion Laboratory, the Applied Physics Laboratory, and Argonne Laboratories, operated and managed as off-site installations by the University of California, California Institute of Technology, Johns Hopkins University, and the University of Chicago, respectively. These university-managed operations contribute significantly to the Nation's research effort. They do not, however, usually engage in the instruction of students or impinge upon the use of classroom and laboratory space.

The other pattern provides support for the work of individual faculty members, usually engaged in research part time, on campus, usually in the traditional departmental setting where graduate and postdoctoral training is tightly integrated into the warp and woof of the total research activity. This pattern also provides support for full-time research staff, generally in a departmental or research institute framework, and involves a substantial number of graduate students and postdoctoral research fellows. The distinction between the large-scale center operation and the faculty research pattern is not a matter of black and white; there is a substantial gray area where neither classification fits precisely. Nevertheless, I have focused upon support of the research being carried on by individual

**Table 1.—Expenditures of institutions of higher education: total, for educational and general purposes, and for organized research, selected years 1930–60**

| Year | Expenditures in millions | | | Organized research as percent of— | |
|---|---|---|---|---|---|
| | Total [1] | Educational and general | Organized research | Total | Educational and general |
| 1930 | $508.5 | $379.1 | $18.1 | 3.5 | 4.8 |
| 1940 | 678.6 | 525.5 | 28.1 | 4.1 | 5.4 |
| 1950 | 2,260.0 | 1,717.9 | 227.3 | 10.1 | 13.2 |
| 1952 | 2,486.2 | 1,933.6 | 320.4 | 12.9 | 16.4 |
| 1954 | 2,902.5 | 2,288.4 | 374.9 | 12.9 | 16.4 |
| 1956 | 3,524.7 | 2,788.8 | 506.1 | 14.3 | 18.1 |
| 1958 | 4,543.6 | 3,634.1 | 733.9 | 16.1 | 20.2 |
| 1960 (est) | [2] 6,000.0 | [2] 4,500.0 | [3] 1,200.0 | 20.0 | 26.7 |
| Ratio 1960/1930 | 12:1 | 12:1 | 66:1 | 6:1 | 6:1 |

[1] In addition to educational and general expenditures, includes student aid expenditures, other current expenditures, and expenditures for auxiliary enterprises.

[2] Author's estimate, taking into account the increase in expenditures for organized research and the growth curve for total expenditures between 1952 and 1958.

[3] Author's estimate, computed from $845.7 million in Federal support of research in universities (National Science Foundation, Federal Funds for Science IX) by assuming that the Federal share continues to approximate 70 percent of the total.

Source: Data for 1930–58 for the aggregate United States from U.S. Department of Health, Education, and Welfare, Office of Education, Biennial Survey of Education. Data for 1960, author's estimates.

**Table 2.—Expenditures for organized research in institutions of higher education, by type of institution, 1954, 1956, 1958**

| Type of institution | Expenditures for organized research (Amounts in millions) | | | | | | Organized research as percentage of educational and general expenditures | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1954 | | 1956 | | 1958 | | 1954 Percent | 1956 Percent | 1958 Percent |
| | Amount | Percent | Amount | Percent | Amount | Percent | | | |
| Total | $374.9 | 100.0 | $506.1 | 100.0 | $733.9 | 100.0 | 16.4 | 18.1 | 20.2 |
| Universities | 302.3 | 81 | 422.8 | 84 | 600.6 | 82 | 22.3 | 24.5 | 27.0 |
| Public (81) | 184.6 | 49 | 264.3 | 52 | 381.4 | 52 | ..... | ..... | ..... |
| Private (60) | 117.7 | 32 | 158.5 | 32 | 219.2 | 30 | ..... | ..... | ..... |
| Technological schools | 57.2 | 15 | 67.2 | 13 | 107.6 | 15 | 33.0 | 37.4 | 41.3 |
| Public (24) | 8.0 | 2 | 2.2 | ..... | 2.9 | ..... | ..... | ..... | ..... |
| Private (21) | 49.2 | 13 | 65.0 | 13 | 104.7 | 14 | ..... | ..... | ..... |
| All other | 15.4 | 4 | 16.1 | 3 | 25.7 | 3 | 2.0 | 1.8 | 2.2 |

Source: Resources Analysis Section, Office of Program Planning, National Institutes of Health: Special analysis of data reported by the U.S. Department of Health, Education, and Welfare, Office of Education, Biennial Survey of Education.

faculty members and have excluded university-managed research centers from the first two sections of this analysis because: (1) Only a few of the leading educational institutions operate research centers, whereas faculty research is common to all major educational institutions; and (2) faculty research affects the financing of virtually all departments and activities within a university—the recruitment, compensation, and retention of faculty; the utilization of facilities; and the instruction of students and the training of scientists.

In its quadrennial surveys the National Science Foundation identifies the support of research carried on by individual faculty members as "Separately Budgeted Research by Colleges and Universities, Proper." Expenditures for such research increased from $205.5 million in 1954 to $327.5 million in 1958—3 years ago (table 3). The number of institutions reporting such research jumped 75 percent between 1954 and 1958 while research expenditures rose 60 percent. Analysis by expenditure interval (table 4 and chart 1) shows: (1) Increasing concentration of research expenditures in fewer institutions: about 6.5 percent of the institutions accounted for 57 percent of the total in 1958 as compared with 45 percent in 1954; (2) growing participation by a much larger number of colleges and universities with modest expenditures for research; 48 percent of those reporting spent under $100,000 for research in 1958 as compared with 27 percent in 1954; and (3) substantial increase in the number of institutions with research expenditures exceeding $1 million and, in particular, in the number exceeding $5 million.

**Table 3.—Expenditures for separately budgeted research by number of colleges and universities, proper, reporting, 1954 and 1958 [1]**

| Item | 1954 [2] | 1958 [3] | Increase | |
|---|---|---|---|---|
| | | | Amount | Percent |
| Expenditures (in millions) | $205.5 | $327.5 | $122.0 | 59 |
| Number of institutions reporting | 173 | 302 | 129 | 75 |

[1] Excludes agricultural experiment stations and Federal contract research centers.

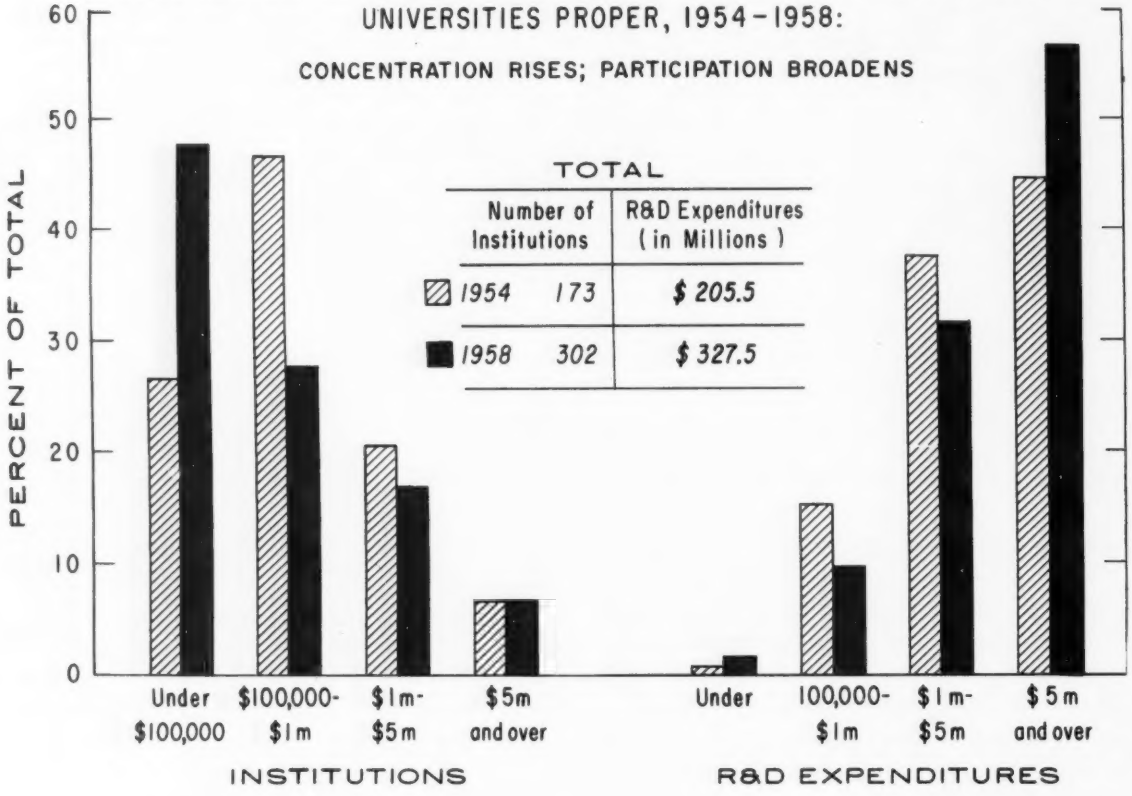
[2] National Science Foundation, Scientific Research and Development in Colleges and Universities, Expenditures and Manpower, 1953–1954, table 9, p. 33.

[3] National Science Foundation, "Funds for Research and Development in Colleges and Universities, Fiscal Year 1958, A Preliminary Report," Reviews of Data on Research and Development, No. 19, April 1960, table 2, p. 6.

CHART 1

TRENDS IN DISTRIBUTION OF SEPARATELY BUDGETED R&D IN COLLEGES AND UNIVERSITIES PROPER, 1954–1958:

CONCENTRATION RISES; PARTICIPATION BROADENS




## SHIFT IN CHARACTER AND COMPOSITION OF FEDERAL SUPPORT

Between 1940 and 1952 Federal support of this research in institutions of higher education increased tenfold: from $15 million to over $150 million. In 1940 the Department of Agriculture provided the bulk of all Federal support for such research. In 1952, the academic community depended heavily upon the military agencies for sponsorship of research. Since 1952, this situation with respect to Federal support for faculty research has changed gradually—almost imperceptibly—as the facts show:

(1) Support by the military agencies has dropped from 70 percent to 31 percent of federally sponsored research in universities;[3]

(2) the nonmilitary agencies now support more than two-thirds of the total; and

(3) the National Institutes of Health has emerged as the leading Federal sponsor of university research; the National Institutes of Health and National Science Foundation together now provide nearly one-half of all Federal funds for separately budgeted research by colleges and universities, proper—meaning research by individual faculty members (table 5 and chart 2).

This radical but little-heralded shift in the composition of Federal agency support has been accompanied by an equally significant shift in the mechanism by which support is provided. Today the dominant mode of support is by grant rather than by contract. This change has influenced the character of review, the freedom of inquiry, and the stability of support. Research proposals are usually

[3] This analysis is limited to support for faculty research. It excludes university-managed research centers such as those described earlier.

reviewed by the applicant's scientific peers, employing the criteria of scientific merit, promise, and feasibility. The terms and conditions of research grants have been liberalized to give the scientist greater freedom of inquiry. What is more important, most grants provide long-term support, assuring greater stability for the investigator and transforming "soft" into hard money for the institution.

**Table 4.—Expenditures by colleges and universities, proper, for separately budgeted research and development, by expenditure interval 1954 and 1958** [1]

| Research and development expenditure interval (In thousands of dollars) | Percentage distribution of— | | | |
|---|---|---|---|---|
| | Institutions | | Research and development expenditures | |
| | 1954 [2] | 1958 [3] | 1954 [2] | 1958 [3] |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |
| Under 100 | 26.6 | 47.7 | .8 | 1.3 |
| Under 10 | 10.4 | 8.3 | .1 | (4) |
| 10–24 | | 19.2 | | .3 |
| 25–99 | 16.2 | 20.2 | .7 | 1.0 |
| 100–999 | 46.8 | 28.8 | 15.4 | 9.8 |
| 100–249 | 20.2 | 13.6 | 2.7 | 2.0 |
| 250–499 | 13.3 | 7.9 | 4.2 | 2.7 |
| 500–999 | 13.3 | 7.3 | 8.5 | 5.1 |
| 1,000–4,999 | 20.2 | 16.9 | 38.6 | 31.9 |
| 1,000–2,999 | 15.0 | 14.6 | 20.7 | 24.6 |
| 3,000–4,999 | 5.2 | 2.3 | 17.9 | 7.3 |
| 5,000–over 10,000 | 6.4 | 6.6 | 45.2 | 57.0 |
| 5,000–9,999 | 6.4 | 4.6 | 45.2 | 30.4 |
| 10,000 and over | | 2.0 | | 26.6 |

[1] Excludes agricultural experiment stations and Federal-contract research centers.

[2] Data from 173 institutions reporting $205.5 million expenditures for research and development; from National Science Foundation, Scientific Research and Development in Colleges and Universities, Expenditures and Manpower, 1953–54, table 9, p. 33.

[3] Data from 302 institutions reporting $327.5 million expenditures for research and development; from National Science Foundation, "Funds for Research and Development in Colleges and Universities, Fiscal Year 1958, A Preliminary Report," Reviews of Data on Research and Development, No. 19, April 1960, table 2, p. 6.

[4] Less than 0.1 percent.

Linked to these two changes has been a third development of equal significance. The agencies involved, their advisory groups, and congressional committees have taken the view that support of research in universities encompasses support for research facilities and the training of manpower for tomorrow's research. To implement this objective, the National Institutes of Health, the National Science Foundation, and other agencies have initiated manpower and facilities resources programs designed to strengthen the Nation's research structure and to increase its capabilities for future growth. Taken together, these three developments—the rising tide of civilian agency support, the swing from contracts to grants, and the initiation of substantial resource programs aimed at enlarging the supply and improving the quality of scientific manpower and providing research facilities and equipment—have exerted a profound influence upon the financing of higher education.

## IMPACT

The general impact of research on the financing of higher education is self-evident. In some institutions the cost of this research represents more than half of the university's total budget. It accounts for over one-fourth of the Nation's expenditures for educational and general purposes in universities. But to determine the impact of research funds upon the financing of higher education, we must look behind these aggregates and examine their influence on costs, staffing, facilities, and students.

### The issue of paying full costs

Many university officials claim that the funds received for the support of research do not cover the full cost to their institutions of such activities.[4] To remedy this condition, universities have sought by negotiation with the military agencies to: (1) Obtain reimbursement for the full indirect costs and (2) devise formulas which are now embodied in the "blue book" for establishing university-wide rates that would vary with the unique cost conditions at each institution. However, a new situation has arisen as National Institutes of Health and National Science Foundation research grants have become the domi-

[4] Admittedly this statement oversimplifies a complex problem, which cannot be fully unraveled within the scope of this article.

**Table 5.—Federal support of separately budgeted research and development in colleges and universities, proper, by agency, selected years, 1952–61** [1]

| Agency | 1952 | 1954 | 1956 | 1958 | 1960 | 1961 [2] (est) |
|---|---|---|---|---|---|---|
| | Amounts in millions | | | | | |
| Total | $151.2 | $140.9 | $171.8 | $282.3 | $464.1 | $489.4 |
| Department of Defense | 105.5 | 80.8 | 82.6 | 118.2 | 161.9 | 154.3 |
| Atomic Energy Commission | 13.4 | 16.4 | 18.3 | 30.2 | 42.1 | 49.0 |
| Department of Health, Education, and Welfare | 14.4 | 23.4 | 30.6 | 78.9 | 155.5 | 164.8 |
| (National Institutes of Health) | (14.4) | (23.4) | (29.7) | (74.7) | (148.4) | (156.8) |
| Department of Agriculture | 13.1 | 14.0 | 25.0 | 31.1 | 31.2 | 32.2 |
| National Science Foundation | 1.0 | 3.5 | 10.9 | 20.7 | 59.5 | 69.0 |
| Other agencies | 3.8 | 2.8 | 4.4 | 3.2 | 13.9 | 20.1 |
| | Percentage distribution | | | | | |
| Total | 100 | 100 | 100 | 100 | 100 | 100 |
| Department of Defense | 70 | 57 | 48 | 42 | 35 | 31 |
| Atomic Energy Commission | 9 | 12 | 11 | 11 | 9 | 10 |
| Department of Health, Education, and Welfare | 9 | 17 | 18 | 28 | 34 | 34 |
| (National Institutes of Health) | (9) | (17) | (17) | (26) | (32) | (32) |
| Department of Agriculture | 9 | 10 | 15 | 11 | 7 | 7 |
| National Science Foundation | 1 | 3 | 6 | 7 | 13 | 14 |
| Other agencies | 3 | 2 | 3 | 1 | 3 | 4 |

Detail may not add to 100 because of rounding.

[1] Excludes Federal-contract research centers. Data from National Science Foundation, Federal Funds for Science, series.

[2] Estimate published in Federal Funds for Science IX, based on President's Budget prior to congressional action. Actual Federal support exceeded $600 million in colleges and universities, proper, in 1961.

nant mode of Federal support for faculty research in universities. Such grants provide a flat rate for indirect costs as a percentage of total direct costs. This procedure differs from the military practice of paying a separately negotiated rate that varies from institution to institution.

The issue has shifted from reimbursement for indirect costs to reimbursement for the full costs, both direct and indirect, of grant-supported research. By and large this issue has been answered in the affirmative insofar as the Federal Government is concerned, with the reservation that cost sharing is always subject to negotiation. I say "by and large" for these reasons:

(1) The House Appropriations Committee, unconvinced that a flat 15-percent rate is inadequate for indirect costs of research supported by the National Institutes of Health grants, has rejected proposals to raise that rate; and

(2) the National Science Foundation has consistently favored a flat rate for all grants instead of varying rates negotiated with each institution.

The reservation of the House Committee rests in part upon the knowledge that: (1) Funds for direct costs may be used to pay faculty salaries, including the institution's contribution to social security and other insurance and annuity plans; (2) title to equipment purchased for use on a research-grant project is vested in the institution, and such equipment is likely to be used by many scientists and science graduate students not connected with the project; and (3) advance payments provide a tangible fringe benefit in the form of short-term investments. The reluctance of the committee is rooted deeply in the conviction that general aid constitutes a better solution for bridging the gap between income and expenditures than raising the indirect cost rate.

Thus, the issue ahead with respect to full costs is not *whether* they are to be paid by the Federal Government, but *how* they are to be determined and *how much* they may amount to. Approximations that are roughly equitable, administratively feasible, and politically acceptable may prove adequate. On the other hand, it may be necessary to resort to cost determination and negotiation procedures such as those currently applied to research contracts.

### Staffing

The terms and conditions of sponsored research in universities have influenced college and university staffing in a number of ways. They have:

(1) Attracted research-oriented scientists to academic careers, but predominantly in nontenure positions;

(2) increased the number of faculty-research staff far out of proportion to enrollment growth, especially at the graduate and professional levels;

(3) reduced the teaching workload of individual faculty members;

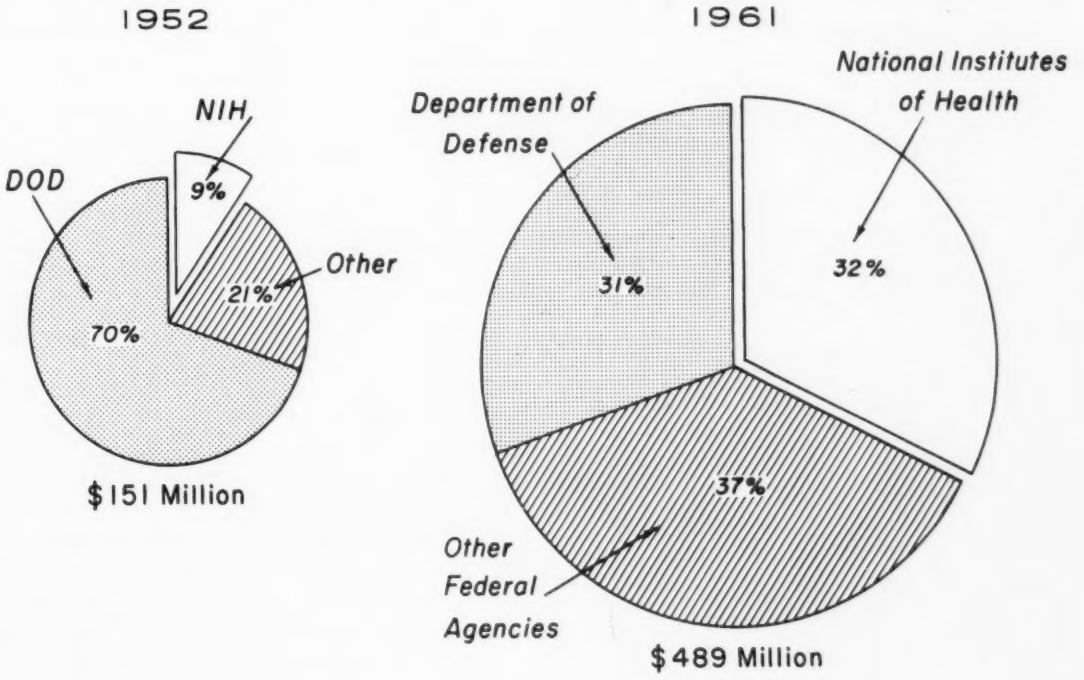
(4) increased the proportion of faculty time devoted to research as compared with teaching;

(5) shifted a larger share of the salary burden to the sponsors of research, and especially to the Federal Government. (To some extent this is social bookkeeping pure and simple. To the extent that universities use this opportunity to expand their faculties, then each dollar of the institution's funds buys a larger quantity of total faculty effort);

(6) enabled the institutions to cope more easily with the 6-percent annual increase in faculty salaries, especially where a rising proportion of science-faculty salaries is paid through research grants and

CHART 2

TRENDS IN FEDERAL SUPPORT OF RESEARCH AT COLLEGES AND UNIVERSITIES, 1952-1961




Source: Derived from Federal Funds for Science, II & IX, National Science Foundation, Washington, D.C.



618955—61——2

contracts; the added cost is absorbed by a third party not involved in the negotiations.

(7) facilitated the recruitment of junior faculty members through subsidizing their period of postdoctoral training either through employment as research associates or more directly as postdoctoral research fellows.

Research has had a substantial impact in terms of the sheer number of university scientists and engineers engaged in this activity either part time or full time: between 1954 and 1958 the number of scientists and engineers (including graduate students in faculty research) rose from 43,315 to 61,635, a total increase of 40 percent and an average annual increase of approximately 4,500. (See table 6; to insure comparability, I have included graduate students employed as research assistants in the totals for both years because it is not possible to distinguish them within the aggregate for 1958.) The number of faculty members engaged full time in research rose from 7,000 to 10,400—roughly a 50-percent increase—between 1954 and 1958.[5]

More significant than the sharp increase in faculty members engaged full time in research is the steadily rising proportion of faculty salaries paid from research funds. In 1958, the salaries of nearly three-fifths of all university scientists in research were paid from grant or contract funds, either wholly or partially, and more than one-third of them entirely from grant or contract budgets. The figures are given in table 7. Unfortunately, these data indiscriminately mix faculty with graduate students and a further breakdown is unavailable at this time.

Information for a breakdown of faculty and graduate students in research is available for medical schools. In the academic year 1959–60 about 25 percent of the full-time faculty members in medical schools were paid partly through support from Federal research or training grants; more than 50 percent of the salary of roughly 1 out of every 7 came from such sources (chart 3). These data indicate the average for all 85 medical schools taken together.

**Table 6.—Scientists and engineers engaged in faculty research at colleges and universities, 1954 and 1958**

| Type of personnel | 1954 | 1958 [1] | Increase | |
|---|---|---|---|---|
| | | | Number | Percent |
| Total | 43,315 | [2] 61,635 | 18,320 | 42 |
| Scientific and professional personnel | [3] 31,455 | ..... | ..... | ..... |
| Graduate students | [4] 11,860 | ..... | ..... | ..... |

[1] 1958 total: National Science Foundation. "Scientists and Engineers Engaged in Research and Development in Colleges and Universities, 1958, A Preliminary Report," Reviews of Data on Research and Development, No. 27, April 1961, table 3, p. 4.

[2] In 1958 graduate students engaged in research were included in the total but not identified separately.

[3] 1954 Scientific and professional personnel from National Science Foundation, Colleges and Universities, Expenditures and Manpower, 1953–54, p. 62–63.

[4] 1954 Graduate students: National Science Foundation, Graduate Student Enrollment and Support in American Universities and Colleges, 1954, p. 35.

[5] National Science Foundation, "Scientists and Engineers Engaged in Research and Development in Colleges and Universities, 1958, A Preliminary Report," *Reviews of Data on Research and Development*, No. 27, April 1961.

**Table 7.—Scientists and engineers engaged in research and development in 377 colleges and universities, by source of salary support, 1958 [1]**

| Source of salary support | Number | Percent |
|---|---|---|
| Total [2] | 50,294 | 100.0 |
| Entirely by grant or contract | 17,565 | 34.9 |
| Partly by grant or contract, and partly by institution | 11,560 | 23.0 |
| Entirely by institution | 21,169 | 42.1 |

[1] National Science Foundation, "Scientists and Engineers Engaged in Research and Development in Colleges and Universities, 1958, A Preliminary Report," *Reviews of Data on Research and Development*, No. 27, April 1961, table 3, p. 4.

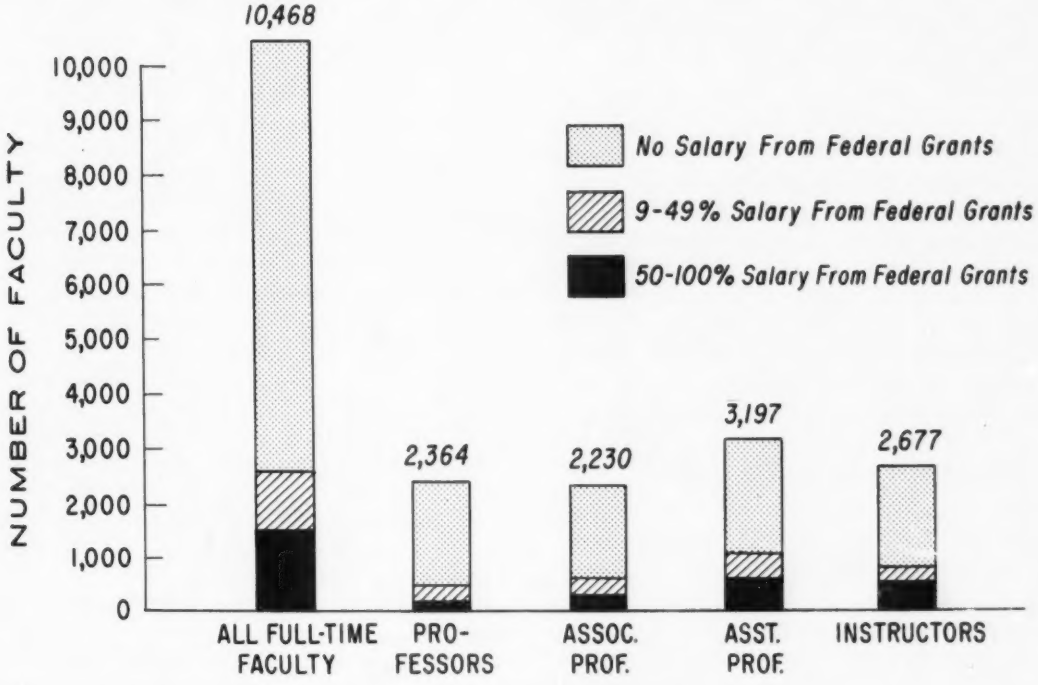
[2] Excludes Federal research centers and agricultural experiment stations.

Such an analysis does not differentiate between those institutions that paid faculty salaries from Federal grant funds and those that prohibited this practice. If the analysis were limited to the former group only, the proportion of faculty paid more than half their salaries from Federal grant funds would increase, perhaps substantially.

The wisdom and propriety of paying faculty salaries with research funds were touched upon only gingerly by the National Science Foundation in its 1958 report, *Government-University Relations*. However, in 1960 the Seaborg Panel of the President's Science Advisory Committee firmly grasped this nettle when it recommended that universities, as a

CHART 3

NUMBER OF FULL-TIME MEDICAL SCHOOL FACULTY RECEIVING A PORTION OF THEIR SALARY FROM FEDERAL TRAINING AND/OR RESEARCH GRANTS




Source: Journal of American Medical Association, Education Number, 1959-60, 174: 1442, Nov. 12, 1960

matter of national policy, should "strengthen their faculties for both research and graduate teaching by accepting and using Federal as well as non-Federal support for faculty salaries." [6]

In the interim between the two reports, many institutions had already changed their policies with respect to payment of faculty salaries from grant or contract sources; others may be expected to follow their lead in the direction recommended by the Seaborg Panel. As a consequence, the continued availability of research funds for the payment of faculty salaries is crucial for budgetary planning in a steadily increasing number of institutions of higher education.

[6] The President's Science Advisory Committee, *Scientific Progress, Universities and the Federal Government*, 1960, p. 23.

**Facilities**

As research activities have expanded and exerted pressure upon limited space, some institutions have responded to this space squeeze by allocating to research some space previously utilized for other activities.

In recent years this pressure has been alleviated—though by no means adequately—by the availability of matching funds for the construction of health research facilities and computer facilities and the purchase of costly laboratory equipment. The Health Research Facilities program, for example, has awarded more than $150 million in Federal funds to universities since 1957. This program has resulted in capital expenditures of more than $600 million for health research and related facilities and

assisted more than 300 academic institutions, in every State of the Union, in constructing or renovating approximately 20 million square feet of research space. Thus, every Federal dollar has stimulated the investment of more than 3 non-Federal dollars. The construction of modern, well-equipped research facilities not only enables the institution to expand its research effort, but also provides sorely needed space for graduate research training in the sciences.

On the one hand, the availability of matching funds for research facilities has channeled university building funds away from construction of new classroom space. On the other, this availability of funds has stimulated large-scale fundraising campaigns so that many institutions have been able to take advantage of the booster effect of matching funds. All in all, however, there can be little doubt that the university's building priorities have been strongly influenced and perhaps distorted because Federal matching funds have been available for research space but unavailable for classroom space.

### Students

The rapid growth of research activities has generated fellowship and training programs designed to expand the supply of research scientists. These programs, which are inextricably linked to the support of research itself, have revolutionized the financing of graduate education. For the most able students in the sciences, graduate education is almost entirely subsidized. More than 30,000 graduate students in the sciences in 1960 were employed as research assistants on projects supported by Federal grants or contracts.[7] About 5,000 full-time predoctoral students in selected science fields were receiving stipends through fellowships and under training grant programs at 80 leading schools.[8]

These programs have—

(1) relieved universities of a substantial burden of support of graduate students;
(2) released funds that can be allocated to support students in nonscience fields;
(3) accelerated the flow of students through graduate training and thereby expanded the supply sooner than it could have been expanded without such support; and
(4) provided in some programs a cost-of-education allowance paid to the institution, and thereby directly aided the university in financing its graduate training programs.

### Implications

Available data indicate that federally sponsored research programs have brought tremendous benefits to universities and technological schools in terms of staff, facilities, students, and fringe benefits and that such programs now constitute a vital form of aid to higher education. However, it must be noted that research has been purchased by the military agencies as a service or commodity—not to aid higher education, but rather to utilize the most competent suppliers. Similarly, research of interest to the sponsoring agencies has been supported on the basis of scientific merit or promise in the arena of national competition. Support of research in higher education strictly on the basis of competence or merit has avoided the issues of racial discrimination and religious preference that have stymied nearly all attempts to provide general Federal aid to higher education.

There are many indications that Federal agencies have dropped their laissez-faire attitude toward the effect of Federal sponsorship of research upon higher education. Civilian agencies such as the National Institutes of Health and the National Science Foundation have become increasingly concerned with the "university as a whole" and with the total effect of Federal research programs upon the structure, character, and financing of higher education. We can understand their concern if we consider the probable future growth of research in higher education and the challenges likely to be presented by it.

## PROJECTION FOR 1970

This projection treats higher education as a sector of the research economy. Hence, it includes research in university-managed research centers as well as the type of faculty research which has been the main focus of the preceding discussions in this paper. A 1970 projection of $3.5 to $4.0 billion for such research expenditures by institutions of higher education seems reasonable. The projection is limited to current expenditures for research. It does *not* include outlays for research plant and equipment

[7] *Budget of the United States Government* for Fiscal Year 1961, Special Analysis of Federal Research and Development Programs, p. 10.

[8] U.S. Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health, "Trends in Graduate Enrollment and Ph. D. Output in Selected Science Fields at 80 Leading Schools, 1959–60 and 1960–61," *Resources Analysis Memo No. 3*, June 1961.

or the costs of research training, both of which should be viewed as capital expenditures for research resources.

The 1970 projection has been developed by assuming that (1) the Nation's expenditures for research and development will continue to rise as a percentage of the gross national product; (2) the higher-education share of these expenditures for research and development will increase slightly, from 9 to 10 percent of the total; and (3) expenditures for research in higher education will continue to grow at the rate of $250 to $300 million annually, whether or not total expenditures for research and development grow as rapidly as my projections indicate.

Such projections are useful in establishing probable ranges of expenditures in terms of general orders of magnitude; they are essential in appraising the potential impact of research upon the financing of higher education in the decade ahead. Inevitably, such projections draw upon past experience, take account of prevailing trends, and then reflect the judgment and the bias of the person making the projection.

The Nation's total expenditures for research and development more than quadrupled during the fifties, from $2.9 billion in 1950 to an estimated $13.5 billion in 1960 (table 8). Expenditures for this research in institutions of higher education more than kept pace, rising from $227 million to $1.2 billion—an increase of 430 percent as compared with 365 percent for total research and development. College and university research expenditures fluctuated as a proportion of total research and development—hovering around 8 percent between 1950 and 1955, dropping to 6 percent in 1957, and then moving upward steadily to 8.9 percent in 1960.

Expenditures for research and development have increased steadily as a share of the gross national product, from 1.02 percent in 1950 to 2.68 percent in 1960. Simple extrapolation of this 0.166 percent

Table 8.—Growth of gross national product and of expenditures for research and development in the Nation and in colleges and universities, 1950–60

| Year | Gross national product [1] | Expenditures for research and development | | | |
|---|---|---|---|---|---|
| | | Total, national [2] | | Colleges and universities [3] | |
| | Amount (In billions) | Amount (In billions) | Percent of gross national product | Amount (In millions) | Percent of total national expenditure for research and development |
| 1950 | $284.6 | $2.9 | 1.02 | $227.3 | 7.8 |
| 1951 | 329.0 | 3.4 | 1.03 | 273.8 | 8.1 |
| 1952 | 347.0 | 3.8 | 1.10 | 320.4 | 8.4 |
| 1953 | 365.4 | 5.2 | 1.41 | 385.2 | 7.4 |
| 1954 | 363.1 | 5.6 | 1.55 | 450.0 | 8.0 |
| 1955 | 397.5 | 6.4 | 1.61 | 480.0 | 7.5 |
| 1956 | 419.2 | 8.5 | 2.02 | 530.0 | 6.2 |
| 1957 | 442.8 | 10.0 | 2.27 | 600.0 | 6.0 |
| 1958 | 444.2 | 11.2 | 2.51 | 735.0 | 6.6 |
| 1959 | 482.1 | 12.4 | 2.58 | 880.0 | 7.3 |
| 1960 | 503.2 | 13.5 | 2.68 | 1,200.0 | 8.9 |
| Percentage increase 1950–60 | 76.8 | 365.5 | ..... | 427.9 | ..... |

[1] Economic Report of the President, January 1961, p. 127.
[2] For years 1950–52 from Department of Defense, The Growth of Scientific Research and Development, 1953; for years 1953–59 from National Science Foundation, "Funds for Research and Development in the United States, 1953–59," Reviews of Data on Research and Development, No. 16, December 1959, chart 2, p. 2; 1960, author's estimate.
[3] For years 1950 and 1952 from U.S. Department of Health, Education, and Welfare, Office of Education, Statistics of Higher Education, ch. 4, sec. II; 1951 and 1953 derived from straight line projection based on data from 1950, 1952, and 1954; 1954–58 National Science Foundation, "Funds for Research and Development in Colleges and Universities, Fiscal Year 1958," Reviews of Data on Research and Development, No. 19, April 1960, table 1, p. 3; 1959 and 1960 author's estimates.

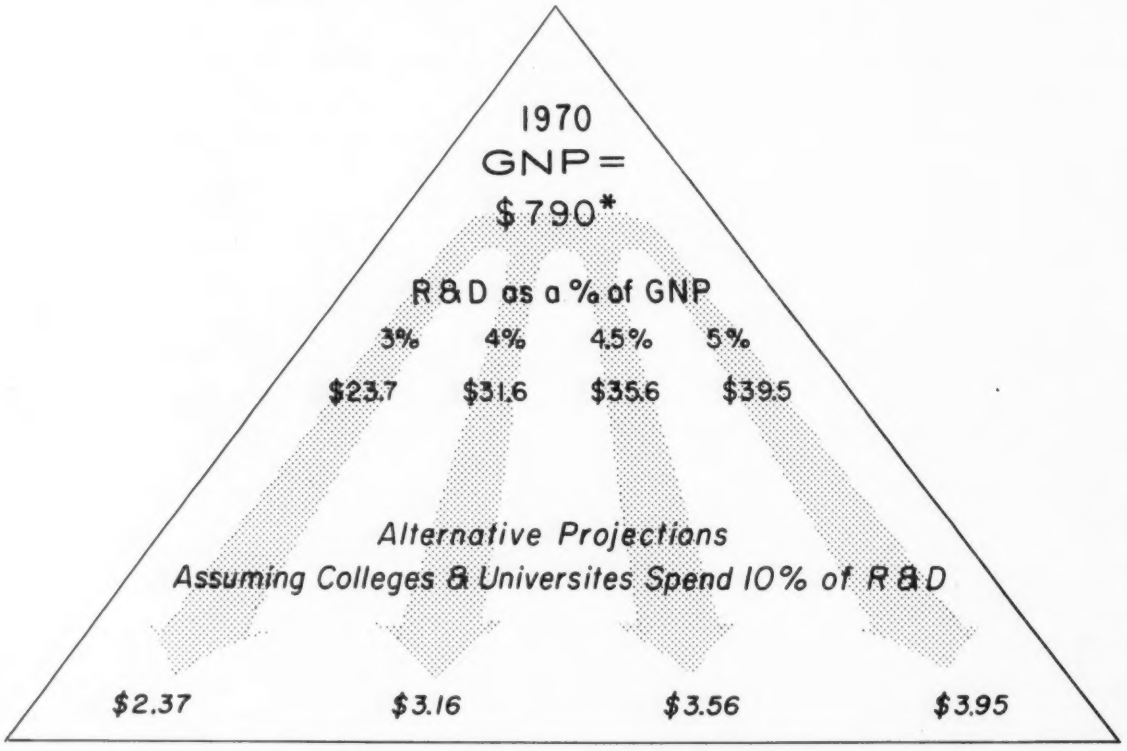
average annual increase would raise the research and development share to 4.34 percent by 1970. I have taken a more flexible approach by developing a range of projections, assuming that expenditures for research and development will approximate from 3 to 5 percent of the gross national product by 1970 (chart 4). For this purpose, I have used the $790 billion judgment model published by the National Planning Association.

National security needs provided the impelling force for the growth of research and development during the fifties. Consequently, I have assumed that any reduction in research and development expenditures for national security will be offset by increased expenditures in other areas such as space exploration, atmospheric sciences, oceanography, automation, protection against environmental hazards, and the development of new products for the civilian market. Admittedly, this assumption cannot easily be tested.[9]

[9] My assumption differs, for example, from Dexter Keezer's as expressed in "The Outlook for Expenditures on Research and Development During the Next Decade," *American Economic Review*, vol. 50, May 1960, pp. 355–369. Keezer's estimate of $22.2 billion for total research and development expenditures in the United States in 1969 is strongly influenced by the assumption that defense research spending will decline and not be compensated for by increase in nondefense research.

CHART 4

ALTERNATIVE PROJECTIONS OF 1970 EXPENDITURES FOR R&D AND FOR RESEARCH IN COLLEGES AND UNIVERSITIES




* Based on Gerhard Colm's "Judgment" Model for 1970, National Planning Association, Long-Range Projections for Economic Growth, Oct., 1959

We can, however, examine the feasibility of the derived projections, which assume that research expenditures by institutions of higher education will approximate 10 percent of the total. The ultra-low projection of $2.37 billion anticipates a doubling of college and university research expenditures in the next decade, in contrast to a fivefold expansion in the fifties; it would call for an average annual increment of $100 million as compared with the present increment of $250 million. For all practical purposes, both the ultra-low projection of $2.37 billion and the low projection of $3.16 billion are products of an arithmetical exercise. I regard them as outside the range of probability.

The high projection of $3.95 billion would require an increase of $2.8 billion, or an average annual increment of $280 million. Even if the Nation's total expenditures for research and development should expand less rapidly as a proportion of the gross national product than is projected, it seems likely that expenditures for research in institutions of higher education will continue to grow at the rate of $250 million to $300 million per year.

While I am personally inclined toward the probability of $4.0 billion or more for college and university research expenditures by 1970, a range of $3.5 to $4.0 billion takes into account the growing participation of more and more educational institutions in research, the continued expansion of research facilities, the future supply of manpower now in the graduate and postdoctoral research training pipeline, and the mounting attraction of research careers for the Nation's youth. Such a projection offers a feasible framework within which we can identify the issues likely to confront college and university presidents, faculty, and research staff on the one hand and Federal agencies with major investments in university research on the other.

## THE TASK AHEAD

Rapport between higher education officials and Federal administrators has greatly improved as they have recognized the bond between science policy and higher education. The national interest in research is firmly established. These considerations increase the Nation's ability to confront the issues posed by a continuing expansion of research.

### Full cost

Payment for the full cost of research by sponsoring agencies is the immediate bread-and-butter issue that dominates the attention of college and university business officers. The more pressing problem, however, is how to bridge the gap between the mounting costs of higher education and the revenues received from research and all other sources. Higher indirect cost rates will help, but I strongly believe that action taken on other issues inherent in the expansion of research will alleviate the situation sooner and more effectively.

### More general support for programs and institutions

Support for individual project applications on the basis of scientific merit without reference to institutional considerations has developed a top quality *national* research program. However, exclusive reliance upon the project system has engendered some problems with respect to the optimum development of research in colleges and universities. To overcome these problems, several Federal agencies have moved toward new and less restrictive forms of research support, bearing in mind the President's Science Advisory Committee's admonition that: "Not only the Nation's security, but its long-term health and economic welfare, the excellence of its scientific life, and quality of American higher education are now fatefully bound up with the care and thoughtfulness with which the Government supports research." [10]

These new forms of support provide general assistance to programs and institutions in a variety of ways: (1) training grants, (2) program grants, (3) institutional grants, and (4) general research support grants.

Training grants, for example, provide general support for research training in specific fields of science. These grants, awarded to academic departments, include provision for faculty salaries, equipment, supplies, and stipends for graduate and postdoctoral students. Training grants invest n academic strength at the point of maximum leverage in the sense that the faculty transmits knowledge, instills competence, and evokes the spirit of inquiry that must provide the essential foundation for research training. A strengthened university depart-

[10] The President's Science Advisory Committee, *Strengthening American Science*, 1958, p. 2.

ment not only gives better research training today, but will also be better prepared to take larger numbers of graduate and professional students in the future and to give them better training than it would otherwise be able to. In this connection, the Seaborg Panel took note of the successful pioneering experience of the National Institutes of Health and urged both the Government and the universities to take action to broaden the scope of training programs.

Program grants are another mode of more general support for research in a broad field of science or a problem area. These grants have been made, for example, to biology departments and to centers for the study of aging. Such grants may also arise from the packaging of individual projects that have been awarded on a piecemeal basis over time and have come to constitute a coherent, integrated program of research. Program grants provide a broader, more flexible basis of support than grants for separate research projects and reduce administrative minutiae encumbering both sponsor and institution.

Perhaps more significant than either of these two is the movement toward institutional grants and general research support grants. This movement recognizes that—(1) institutions have encountered difficulty in maintaining control over the content, emphasis, and direction of their research and training activities; (2) lacking any significant amount of unrestricted money, some schools attempt to expand research in the areas where funds are readily available while other problems of a less dramatic nature but of no less scientific significance have been given lesser priority; (3) strong departments with outstanding researchers attract grant support and grow stronger while weak departments experience greater difficulty in obtaining research support that could give them the impetus for improvement.

The real issue is a lack of financial resources, the resources that would enable the institution to develop equally important activities that the dean, faculty, and research staff know would give greater balance and direction to their research and training programs. In response to this need for more general support, the National Science Foundation has initiated an institutional grant program aimed at strengthening the scientific potential of colleges and universities receiving research grants from the Foundation. The National Institutes of Health is authorized by Public Law 86–798 to set aside an amount not exceeding 15 percent of its research project funds to be used for grants-in-aid for the general support of research and research training in the sciences related to health. In the current fiscal year this new program, which will provide general support for strengthening research and research training capabilities of institutions of higher education and other nonprofit research organizations, has been initiated in schools of medicine, osteopathy, dentistry, and public health.

In the early years, these two programs will provide substantial fluid funds for universities with large-scale research programs, but only "bootstrap" money for lesser institutions, because the procedures currently governing the amounts to be awarded to eligible institutions are closely geared to the level of current research activity. In susbequent years, however, as the total amount available rises, grants for the general support of research and research training may well become one of the more significant forms of aid to higher education. Each of these new developments illustrates the significant strides that have already been taken toward meeting the need for more general support of research in institutions of higher education.

### Creating new centers of excellence

Scientific merit—the criterion of excellence—governs today's decisions to support university research. If the projected expansion of research in the university sector is to be realized, many new centers of excellence must be developed. To some extent this development will take place in the natural course of events as weaker institutions are enabled to provide opportunities for topflight teachers and scientists and their younger proteges who in turn will attract better students. However, the Nation can ill afford to leave this critical transition entirely to the forces of the marketplace. No Federal agency has a mandate to facilitate either the upgrading of faculties, buildings, and equipment of weaker institutions or the creation of new ones. This constitutes a serious gap in national policy which should be bridged if we are to provide positive support for existing institutions with potential and to foster the creation and development of new centers of excellence and research competence—especially in the more rapidly growing regions of the country.

### Expansion of the resource base

Achievement of a $4 billion college and university research effort by 1970 will demand substantial expansion of the Nation's facilities and trained manpower for research. Fortunately, the device of matching grants has proved its worth as an incentive to encourage timely construction of needed research facilities at colleges and universities. Applications for such assistance, however, clearly indicate the need for wider latitude for matching requirements, for more nearly adequate authorization, and for longer-range planning. The prevailing 50–50 matching ratio now imposes severe burdens on the less affluent schools and States and often diverts funds from construction of educational facilities. This drain upon institutional finances will be reduced as matching requirements are modified and the inseparable relation between research and research training is recognized.

The matching incentive, however, is not appropriate for financing costly, highly specialized facilities constructed and operated in the national interest. Such facilities, adequate for sustained and complex research activities, are becoming increasingly strategic for the advancement of science in an ever-widening range of fields. Although these facilities are utilized by university scientists and contribute to graduate and postdoctoral training, they are wholly financed by the Federal Government and, in all likelihood, will continue to be so financed.

With respect to the expansion of manpower resources, the outlook is generally favorable. There are abundant opportunities for careers in research. However, it will probably be necessary to modify existing mechanisms for the support of fellowship and training programs in order to provide a more nearly adequate and flexible framework for expanded activities at the graduate and postdoctoral levels. Moreover, the potential pool of talented youth for research (and for all other intellectual endeavors) could be dramatically expanded if the incentives and opportunities now available for graduate education were extended to the undergraduate level.

### More specialized organization of research activity

Universities have sought to encourage research as a necessary and fruitful complement to teaching by encompassing it within the academic departmental structure. However, as the volume of research expands, it behooves universities and their sponsors to take full cognizance of the emergence of research as a full-time, highly specialized activity. Nearly a decade ago, the president of the Massachusetts Institute of Technology cogently stated the need to evolve new organizational arrangements for research that would foster optimum utilization of scarce talent and costly facilities:

> We would be lacking in our responsibility if we were to fail to push the organization of scientific research to its ultimate conclusion. This road apparently leads to larger laboratories, a growing costliness of facilities, and an increasing need for the planning of programs.
>
> There is a basic incompatibility between the true spirit of a university and those elements of management which tend to creep into the organization of projects, the planning of programs, and the utilization of costly facilities. One must recognize that there may be an ultimate need to establish central institutions to supplement the universities in fundamental research . . . If we strive to contain the widening scope of research entirely within our large universities, we shall end by changing their character and purpose. In so doing, we shall render the greatest possible disservice to the cause of research itself.[11]

This problem will become acute in the years ahead. In some cases, the best solution will be to establish research institutes affiliated with universities or research centers operated by groups of universities; in other cases, to establish independent research organizations outside the academic environment. I cannot agree with those who counsel universities not to regard such institutes as competitors; they will compete for funds, talent, facilities, and recognition of excellence. The real challenge is how to develop research institutes that on balance will complement, not weaken, the Nation's structure for higher education.

### Federal policy

We are witnessing a basic transition in the role of the Federal Government in the advancement of re-

[11] J. A. Stratton, "Research and the University," *Chemical and Engineering News*, vol. 31, June 22, 1953, p. 2582.

search in higher education. Moving from a limited base of operations concerned with project-type research support for individual scientists, the Federal Government is undertaking a more difficult role aimed at bringing into being a new concept and framework for the support of university research in the years ahead. This more creative role involves anticipation of future needs, stimulation and development of research resources essential to future growth, concern with terms and conditions that increase the vigor of institutions and foster the freedom and productivity of investigators, and expansion of international research activities in consonance with the National interest.

In this new role, the Federal Government will have to—

(1) reconcile the virtues of diversity of sources of Federal support and multiplicity of programs with the growing necessity for central policy direction and control of Federal programs within the executive branch;

(2) develop mechanisms that will provide a continuing, effective appraisal of the total impact of research upon all major aspects of higher education, including financing;

(3) provide a focal point where universities can present their total needs and resources; and

(4) develop a method of communication whereby all institutions of higher education may be informed about the status and prospects of all Federal programs directly involving the academic community.

I shall not labor the first three points concerning which there is sufficient concensus to permit me to assume that they have become self-evident propositions. With respect to the issue of systematic communication, it has been said that:

> To realize the possibilities for Federal support, a university needs—and a small college cannot afford one—a full-time specialist in Washington, perhaps more than one, who has entries into a dozen or more agencies. The university lacking such a ubiquitous figure is not represented as a university.[12]

Although this view may exaggerate the situation, it is true that many institutions have been unable to keep abreast of rapidly evolving opportunities scattered among many agencies and spanning a wide variety of programs and mechanisms. To help cope with this problem, I would propose an annual assembly of university representatives and Federal officials. Such an assembly would (1) enable Federal officials to brief university representatives on major new developments and (2) provide each institution with an opportunity to obtain complete information on programs of special relevance to its interests and capabilities. The assembly perhaps might also convene in workshops, each devoted to a major topic, such as facility needs, cooperative studies, international programs, research centers. When compared with the potential benefits of improved communication, wiser choice, and more effective utilization of university research resources, the obstacles to staging such an enterprise seem small indeed.

## General aid

Educational institutions desperately need new sources of support to meet steadily rising operating expenditures. Although federally sponsored research contributes a cash flow of considerable dimensions and has a crucial impact upon the financing of many institutions of higher learning, it is no substitute for general aid. However, as the Federal Government moves toward general aid, the experience gained through Federal support of university research is both relevant and reassuring. It has demonstrated that Federal funds can be provided without restricting the freedom of academic institutions.

[12] The American Assembly, *The Federal Government and Higher Education*, Columbia University Press, New York, N.Y., 1960, p. 161.

### New science resources planning office

The National Science Foundation has established a Science Resources Planning Office (SRPO) to serve as a focus for studies of the Nation's future needs and resources for research and education in science.

In announcing SRPO, Alan T. Waterman, director of NSF, says that the importance of scientific progress and the rapid growth of our science and technology call for increased abilities to analyze trends, to study the effects of Federal programs on the conducting of research and teaching in science, and to anticipate future demands on the Nation's science resources.

In studying these resources, the SRPO will use information developed in cooperation with educational institutions, with industrial groups, and with Government agencies. It will also encourage and sponsor relevant studies by other organizations, both public and private.

# Implications of Present Military Manpower Build-Up For College and University Faculty and Students*

### Selective Service

Under present and prospective draft calls, no changes in the college and university student deferment program, in the occupational deferment program, or in the present order of call for induction are anticipated.

College students may be deferred so long as their studies are considered necessary to the maintenance of the national health, safety or interest. Specific criteria relating to class standing and test scores on the Selective Service College Qualification Test are included in the Selective Service regulations for guidance purposes. Local boards are not required to defer solely on the basis of those criteria, however.

Similarly, local boards may defer registrants occupationally if their activity in industry, research, medical, scientific or other endeavors is found necessary to the maintenance of the national health, safety or interest. Subject to the merits of the particular case, college and university faculty members may be considered for occupational deferment. Occupational deferments are presently at, or close to, a peacetime high.

With respect to the order of call for induction, it is expected that calls will continue to be filled by nonfathers between the ages of 19–26, with the oldest going first. With the very modest increases in draft calls, it is estimated that the average age of involuntary induction, which has been about 23, might fall by several months.

Decisions on individual student or occupational deferment cases will continue to be made by local Selective Service boards, subject to appeal. More detailed information on student and occupational deferment regulations is available at local boards.

### Ready Reserve

The Reserve Forces of the Military Departments have been maintained in order that there might be a force available in addition to the active forces when a need exists. They are provided for by law and have been maintained through the expenditure of funds for pay, equipment, and training.

During the current military build-up, only Ready Reservists are being called to active duty. In the case of the National Guard, membership has been entirely voluntary and all members have been paid for their attendance at drills and other training periods. In the case of reserve units, other than the National Guard, membership is voluntary except for those individuals who have a remaining service obligation under law. The great majority of the Ready Reservists being called to active duty at this time have been paid for attendance at drills and other training.

There has been a screening program in existence since 1956 under which an individual in the Ready Reserve could be screened to the Standby Reserve if certain criteria were met. Those members of the Ready Reserve who possess a critical civilian occupation and are determined to be in excess of Ready Reserve requirements for that occupation are transferred to the Standby Reserve upon their application, unless they also possess a critical military skill. The U.S. Department of Labor maintains a List of Critical Civilian Occupations for Screening the Ready Reserve and this list is used to determine the eligibility of an applicant for transfer to the Standby Reserve on the basis of a critical civilian occupation.

* These policy statements, released by Edward L. Katzenbach, Jr., Deputy for Education and Manpower Resources of the Department of Defense, on October 2, are reprinted in full for the guidance of college administrators, faculty members, and students.

Under this policy, Ready Reservists who have been employed at a college level educational institution and have been instructing in subjects required in preparation for entering a profession included on the List of Critical Occupations,[1] or were employed in a key managerial position, should have been transferred to the Standby Reserve prior to the date of the first involuntary recall on 25 August 1961, provided they:

a. Were in excess of Ready Reserve requirements for their skill;
b. Did not qualify in a critical military skill;
c. Did not voluntarily sign an agreement to participate as a Ready Reservist;
d. Submitted information as to their status to their unit commander.

The screening policy also provides for transferring to the Standby Reserve certain students in college and universities who are in their final year of undergraduate work or are students in graduate or professional schools and are majoring in a field of study preparatory to entering a profession appearing on the List of Critical Occupations. Excluded from these provisions are ROTC members, those students who have not had active training and service, those who possess a critical military skill and volunteers who agree in writing to remain in the Ready Reserve for a minimum period of one year.

The detailed criteria governing the screening of college and university students are shown in the appendix attached hereto. In requesting transfer to the Standby Reserve because of his student status, a reservist must submit either a certification from the insititution as to his class standing or submit an affidavit as to his test score.

The screening program also calls for transfers from the Ready Reserve to the Standby Reserve by reason of extreme personal or community hardship.

It is the policy of the Department of Defense to continue to apply the foregoing screening policies and procedures to Ready Reservists who have not been alerted for active duty. Individual reservists who desire consideration under the applicable procedures must take the initiative in requesting such consideration.

If an individual Ready Reservist is in doubt as to his current status, he should be directed to contact the commander of the Reserve unit to which he is currently assigned and request a clarification of his status. It is up to the Ready Reservist to keep his unit commander informed at all times when a change in his status occurs.

After a reservist has been alerted for active duty, he is no longer eligible for screening consideration. Policies have been established in each of the Military Departments, however, under which reservists alerted or ordered to active duty may have their entrance on active duty delayed for extreme personal hardship reasons. Such requests for Army Reserve and Army National Guard personnel assigned to units will be submitted to the reserve unit commanders. Non-unit Army Reserve and Army National Guard personnel, as well as all Navy, Air Force and Air National Guard reservists will submit requests to the authorities who issued their alert notices or active duty orders.

[1] The professional occupations appearing on the Department of Labor list are: agronomist, astronomer, bacteriologist, chemist, clinical psychologist, dentist, engineer, entomologist, geologist, geophysicist, mathematician, osteopath, parasitologist, pharmacologist, physician and surgeon, physicist, physiologist, plant pathologist, and veterinarian.

## APPENDIX

### Screening Standards and Requirements Applicable to Ready Reservsits Who Are Students

The following criteria and standards will be applicable to those Ready Reservists pursuing academic studies that will qualify them for occupations appearing on the List of Critical Occupations for Screening the Ready Reserve:[1]

[1] Except those enrolled or enlisted in programs leading to appointment to commissioned rank and those possessing critical military skills.

#### A. Undergraduate Students

Students who are satisfactorily pursuing studies in their final year of undergraduate work at a college, university or similar school of learning and who are majoring in a field of study preparatory to entering a professional occupation appearing on the List of Critical Occupations for Screening the Ready Reserve, provided that during their last completed year of undergraduate work they achieved a scholastic standing which ranked them for that year within the upper three-fourths of the full-time male

students for that year or have attained a score of 70 or more on the Selective Service College Qualification Test.

**B. First-Year Graduate Students**

Students who have been accepted for admission by a graduate school for the first class commencing after they have been accepted for a full-time course of instruction as a candidate for a graduate degree in a professional occupation appearing on the List of Critical Occupations for Screening the Ready Reserve, other than those covered under C. and E. below, and, if such class has commenced, have entered upon such course, provided that during their last full-time undergraduate year at a college, university or similar institution of learning, they achieved a scholastic standing on that year's work which ranked them for that year within the upper one-fourth of the full-time male students in their class or else attained a score of 80 or more on the Selective Service College Qualification Test, and provided that the graduate school has certified that they are currently meeting degree requirements and are expected to attain their degrees.

**C. First-Year Students in Professional Schools of Medicine, Dentistry, and Allied Health Specialties**

Students who have been accepted for admission by a professional school of medicine, dentistry or allied health specialties appearing on the List of Critical Occupations for Screening the Ready Reserve for the first class commencing after they have been accepted and, if such class has commenced, have entered such school, provided that during their last full-time under-graduate year at a college, university or similar school of learning they achieved a scholastic standing on that year's work which ranked them for that year within the upper one-half of the full-time male students in their class or else attained a score of 70 or more on the Selective Service College Qualification Test, and provided that the school has certified that they are satisfactorily pursuing a full-time course of instruction leading to their graduation.

**D. Graduate Students Who Have Completed Their First Year of Graduate School**

Students who have satisfactorily completed their first year in graduate schools and are satisfactorily pursuing full-time courses as a candidate for a graduate degree in a professional occupation appearing on the List of Critical Occupations for Screening the Ready Reserve, other than those covered under C. and E. herein. In general, requirements for the Master's degree should be completed in not more than 2 calendar years and for the Doctoral degree in not more than 5 calendar years of graduate study.

**E. Students Who Have Completed Their First Year of Study in Professional Schools of Medicine, Dentistry and Allied Health Specialties**

Students who have satisfactorily completed their first year in a professional school of medicine, dentistry or allied health specialties appearing on the List of Critical Occupations for Screening the Ready Reserve and are satisfactorily pursuing full-time courses leading to their graduation.

# Office of Education Studies and Surveys

## Trends in Faculty Salaries

FACULTY SALARY data for 1960–61 received by the Office of Education reveal average salaries of $7,330 for 9–10 month service for the four faculty ranks combined in undergraduate 4-year institutions. The averages for these salaries in public and private institutions are $7,570 and $6,960, respectively. The data also indicate that the average salary for 9–10 month service for the instructional personnel in junior colleges and other 2-year institutions is $6,620 ($7,000 public, $4,910 private). The average for the 1,458 reporting institutions (the 4-year institutions and junior colleges combined) is $7,240 ($7,480 public, $6,830 private). Institutions covered in the survey account for almost 92 percent of the enrollment in public and over 82 percent in private institutions.

Although not necessarily based on data from the same institutions reporting both years, a comparison of the 1960–61 data (1,458 institutions) with the 1959–60 data (1,433 institutions) reveals that average salaries of faculty in undergraduate 4-year colleges and universities increased 7.5 percent in public and 6.9 percent in private institutions and that average salaries of instructional personnel in junior colleges increased by 6.7 percent in public and 5.8 percent in private institutions.

These data, as well as data on tuition and fees and on room and board charges, are reported in detail in *Higher Education Planning and Management Data 1960–61*, by W. Robert Bokelman, Chief, Business Administration Section, Division of Higher Education. (See *New Publications*.)

Data reported in earlier faculty salary surveys conducted by Dr. Bokelman have made possible a 3-year comparison of faculty salaries based on data furnished by the same colleges and universities for each of the years 1957–58, 1958–59, and 1959–60. Trends indicated in the comparative study show

that the average 1959–60 salary of 36,480 faculty members in 200 public 4-year colleges and universities was $7,140—an increase of 5.9 percent over 1958–59 and of 11.6 percent over 1957–58 average salaries. In 332 private 4-year colleges and universities, the average 1959–60 salary for 21,784 faculty members was $6,680—an increase of 6.5 percent over 1958–59 and of 16.3 percent over 1957–58.

The 3-year trends also reveal that the 1-year and 2-year increases in average salaries of seven selected administrative positions (president, director of development, director of public relations, alumni secretary, chief business officer, purchasing agent, and director of library) were slightly lower for most of the administrators when compared with corresponding increases for the four faculty ranks combined.

The 3-year trends in salaries of faculty and selected administrators, as well as trends in tuition and fees and in charges for room and board, are reported in detail in *Trends in Higher Education Planning and Management Data 1957–58 to 1959–60* by W. Robert Bokelman, Chief, Business Administration Section, and Louis A. D'Amico, Specialist for Business Administration, both in the Division of Higher Education. (See *New Publications*.)

## Faculty and Other Professional Staff of Institutions of Higher Education 1959–60

DURING the 2-year period from 1957–58 to 1959–60, the total faculty and other professional staff of the Nation's higher education institutions rose by 9.8 percent, from 348,500 to 382,700. Staff for resident instruction in degree-credit courses rose by 8.7 percent, while resident degree-credit enrollment rose by 10.5 percent.

The 283,100 staff members for resident instruction in degree-credit courses for 1959–60—almost three-fourths of the total faculty and professional staff—included 163,700 full-time and 80,800 part-time faculty members holding the rank of instructor or above and 38,600 junior instructional staff (such as teaching fellows, teaching assistants, and laboratory assistants). These totals represent increases for the 2-year period, as follows: 5.9 percent for full-time staff and 12.3 percent for part-time staff in the rank of instructor or above and 13.8 in the junior professional staff. The full-time equivalent of the 80,800 part-time faculty members in the rank of instructor or above was reported as a full-time staff of 25,600.

The table below summarizes information on the number of staff members performing various types

**Types of positions of faculty and other professional staff in institutions of higher education, 1959–60 and 1957–58**

(Total individuals occupying one or more positions—382,664)

| Staff, by function | Number of positions | | Percent change |
|---|---|---|---|
| | 1959–60 | 1957–58 | |
| Professional staff for general administration | 19,063 | 16,035 | 18.9 |
| Professional staff for student personnel services | 15,299 | 12,863 | 18.9 |
| Faculty for resident instruction in degree-credit courses: total | 283,080 | 260,486 | 8.7 |
| With rank of instructor or above | 244,461 | 226,536 | 7.9 |
| Full time | 163,656 | 154,602 | 5.9 |
| Part time | 80,805 | 71,934 | 12.3 |
| Full-time equivalent of part time | (25,627) | (22,952) | (11.7) |
| Junior instructional staff | 38,619 | 33,950 | 13.8 |
| Faculty for resident instruction in other than degree-credit courses | 14,135 | 12,096 | 16.9 |
| Instructional staff for courses by mail, courses by radio or TV, short courses, and individual lessons [1] | 11,877 | 9,602 | 23.7 |
| Extension staff giving courses | 15,348 | 15,547 | −1.3 |
| Other extension staff positions | 16,091 | 15,831 | 1.6 |
| Professional library staff | 9,939 | 9,099 | 9.2 |
| Professional staff for organized research | 37,099 | 32,531 | 14.0 |
| Instructional staff for elementary or secondary instruction | 9,789 | 9,292 | 5.3 |

[1] Includes a small number reported as "other faculty."

of duties in institutions of higher education in 1959–60 and 1957–58. Since a staff member *may be occupied in more than one official capacity and is shown in each type of duty in which engaged*, the total number of positions reported in the table exceeds the total number of individual staff members.

These data are based on the OE biennial survey of "Faculty and Other Professional Staff: 1st Semester or 1st Quarter 1959–60." A comprehensive report of the survey is in preparation under the general direction of Justin C. Lewis, Division of Statistics and Research Services.

# Other Program Notes

### Acting Director of Higher Education

Commissioner McMurrin has designated R. Orin Cornett as Acting Assistant Commissioner and Director of the Division of Higher Education of the Office of Education, following the resignation of Homer D. Babbidge, Jr. Dr. Babbidge has joined the staff of the American Council on Education as vice president.

### Regional Representatives

U.S. COMMISSIONER OF EDUCATION STERLING M. MCMURRIN has appointed Minard W. Stout and Freeman H. Beets as regional representatives for higher education in region II (New York, N.Y.) and region VI (Kansas City, Mo.) of the Department of Health, Education, and Welfare. They succeed David Dudley and George Rosenlof, respectively.

At the time he accepted the appointment, Dr. Stout was vice president for development at the University of Miami, Coral Gables, Fla. From 1958 to 1960 he was vice president for research and development at Curtiss-Wright Corporation, Wood-Ridge, N.J., and from 1952 to 1958 president of the University of Nevada. He received his Ph. D. degree at the University of Iowa and his B.A. at Iowa State Teachers College.

Dr. Beets served as president of the Oklahoma College for Women from 1958 until September of this year. He has been a professor of journalism and English at Oklahoma College for Women and registrar and director of admissions at Hardin-Simmons College. He received his Ed. D., M.A., and B.A. degrees at the University of Oklahoma.

As regional representatives for higher education, they will assist colleges and universities taking part in higher education programs of the National Defense Education Act and provide services in connection with other programs administered by the Office of Education's Division of Higher Education. The New York regional office serves the States of Delaware, New Jersey, New York, and Pennsylvania; the Kansas City office, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.

## NEW PUBLICATIONS

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(*2*) *Free Publications: Request direct from the agency issuing them.*

#### From the Office of Education

*Cooperative Projects Among Colleges and Universities*, by S. V. Martorana, James C. Messersmith, and Lawrence O. Nelson. Washington, U.S. Government Printing Office, 1961. 45 p. 35 cents. (OE–50020.)

Reviewed in this issue.

*Doctoral Study: Fellowships and Capacity of Graduate Schools*, by John L. Chase, Washington, U.S.

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Government Printing Office, 1961. 65 p. 45 cents. (OE–54016.)

Based on data from 139 doctorate-granting institutions, this report shows the level of graduate support for the principal academic fields, examines the capacity of graduate schools for training additional doctoral candidates, and discusses some of the methods for increasing the number of college teachers with doctorates.

*Higher Education Planning and Management Data, 1960–61*, by W. Robert Bokelman. Washington, U.S. Government Printing Office, 1961. 91 p. 50 cents. (OE–53004–61.)

The fourth of an annual series of OE publications giving data on faculty and administrative salaries, tuition and fees, and room and board in colleges and universities in the United States. Tabular data are analyzed on 4 bases: By control (public and private), by geographic region, by type of institution, and by size of enrollment. See page 21.

*Library Statistics of Colleges and Universities, 1959–60, Advance Analytic Report*, by John Carson Rather and Doris C. Holladay. Washington, U.S. Department of Health, Education, and Welfare, Office of Education, July 1961. 19 p. (OE–15030.)

Presents an analysis of data on library collections, personnel, and expenditures of colleges and universities in the United States.

*NDEA and Higher Education.* Washington, U.S. Department of Health, Education, and Welfare, Office of Education, August 1961. 6 p. (OE–50024–1.)

The first in a series of bulletins to be issued from time to time on developments of the four higher education programs of the National Defense Education Act: Graduate fellowships, student loans, counseling and guidance institutes, and language development. Each future issue of the bulletin will discuss in detail some particular development in one of the programs.

*Progress of Public Education in the United States of America, 1960–61.* Washington, U.S. Government Printing Office, 1961. 77 p. (OE–10005–61–B.)

The English text of the summary report of the Office of Education to the 24th International Conference on Public Education, Geneva, Switzerland, July 3–14, 1961. (See "New Publications," September issue of *Higher Education*.)

*A Statistical Comparison of Professional and Graduate Degrees Awarded by Members of the Association of Graduate Schools and by all U.S. Universities, 1957–58*, by John L. Chase. Washington, U.S. Department of Health, Education, and Welfare, Office of Education, July 1961. 56 p. (OE–54018.)

Supplements an earlier study *A Statistical Comparison of Graduate Degrees Awarded by Members of the Association of Graduate Schools and by all U.S. Universities, 1957–58*, published in September 1960 (OE–54011). The 1961 report supplies data on graduate degrees in the fields omitted from the earlier study (principally psychology and most of the major professional fields other than engineering) and adds data for degrees in professional fields at all levels.

*Teaching by Machine*, by Lawrence M. Stolurow. Washington, U.S. Government Printing Office, 1961. 173 p. 65 cents. (OE–34010.)

A monograph developed in conjunction with a Cooperative Research project in process at the University of Illinois. Discusses machine systems, types of teaching machines, concepts and techniques of programing, research findings related to teaching machines, and implications for education.

*Trends in Higher Education Planning and Management Data 1957–58 to 1959–60*, by W. Robert Bokelman and Louis A. D'Amico. Washington, U.S. Government Printing Office, 1961. 19 p. 25 cents. (OE–53010.)

An analysis of changes in salaries (faculty and selected administrators), tuition and fees, and room and board charges in colleges and universities in the United States, for the years 1957–58 through 1959–60. See page 21.



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